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B63B 35/44

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(54) Marina with driven pontoons

(57) A marina comprises piled parallel main pontoons P1 having secondary pontoons P2 to which are attached hinged finger piers P5. Vessels are securely moored to the pontoons. The secondary pontoons are connectable on the left of the figure by hinged P6 or retractable P7 sections to a shoe, sledge or wheeled carriage 2 located upon an elongate member 1 a component of the main pontoon P1. The arrangement of shoe and rail is duplicated at the right hand end of the secondary pontoons and by the synchronized application of motive power, for example a worm drive mounted on the shoe meshing with a rack gear integral with member 1 the secondary pontoons may be driven together or apart in the direction of the arrows. This movement together with the operation of sections P6 or P7 allows vessels to navigate within the marina as required.

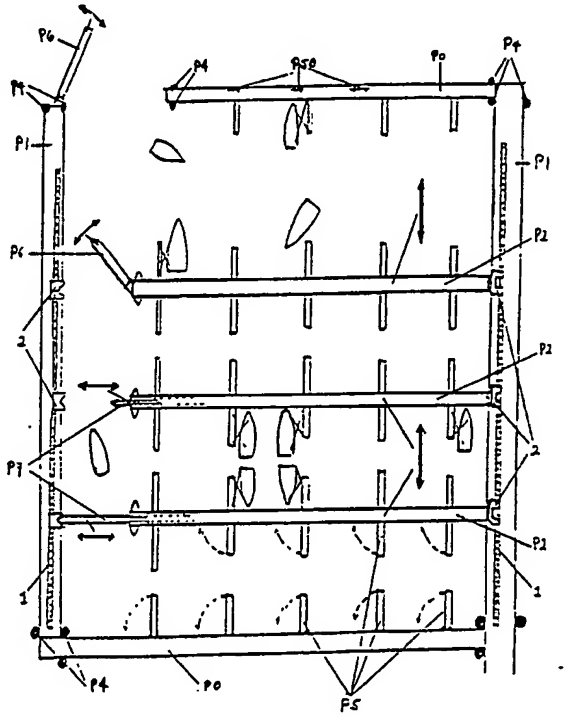
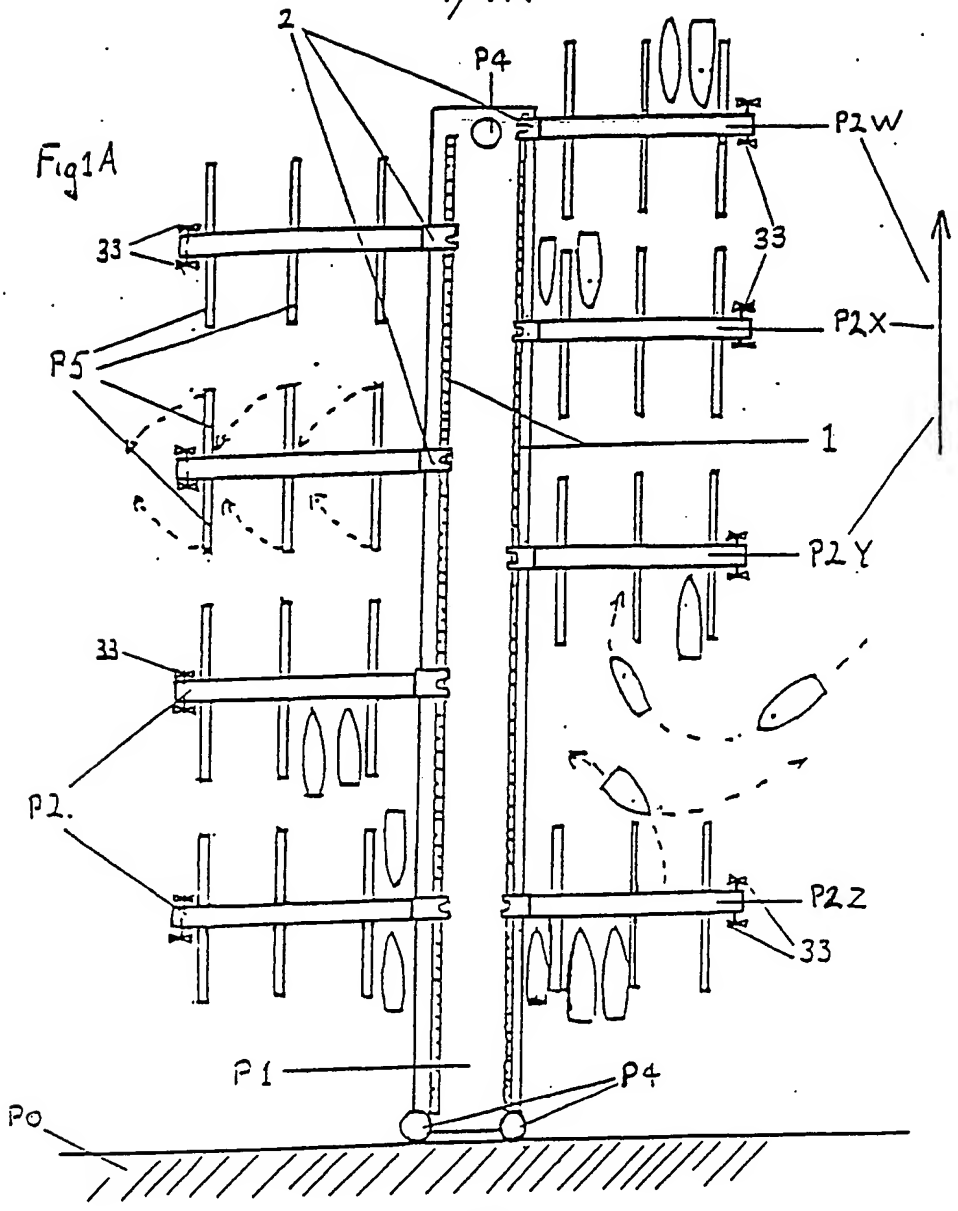


Fig 3A

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1990.

GB 2 236 716 A

Fig 1A



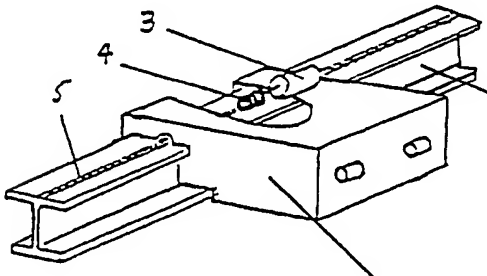


Fig 1B

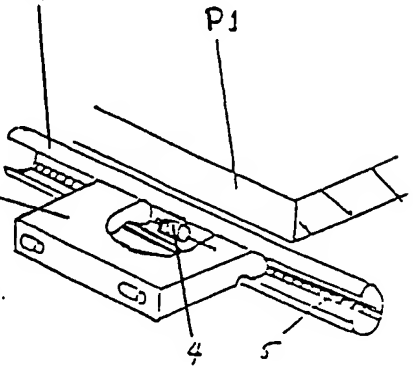


Fig 1C

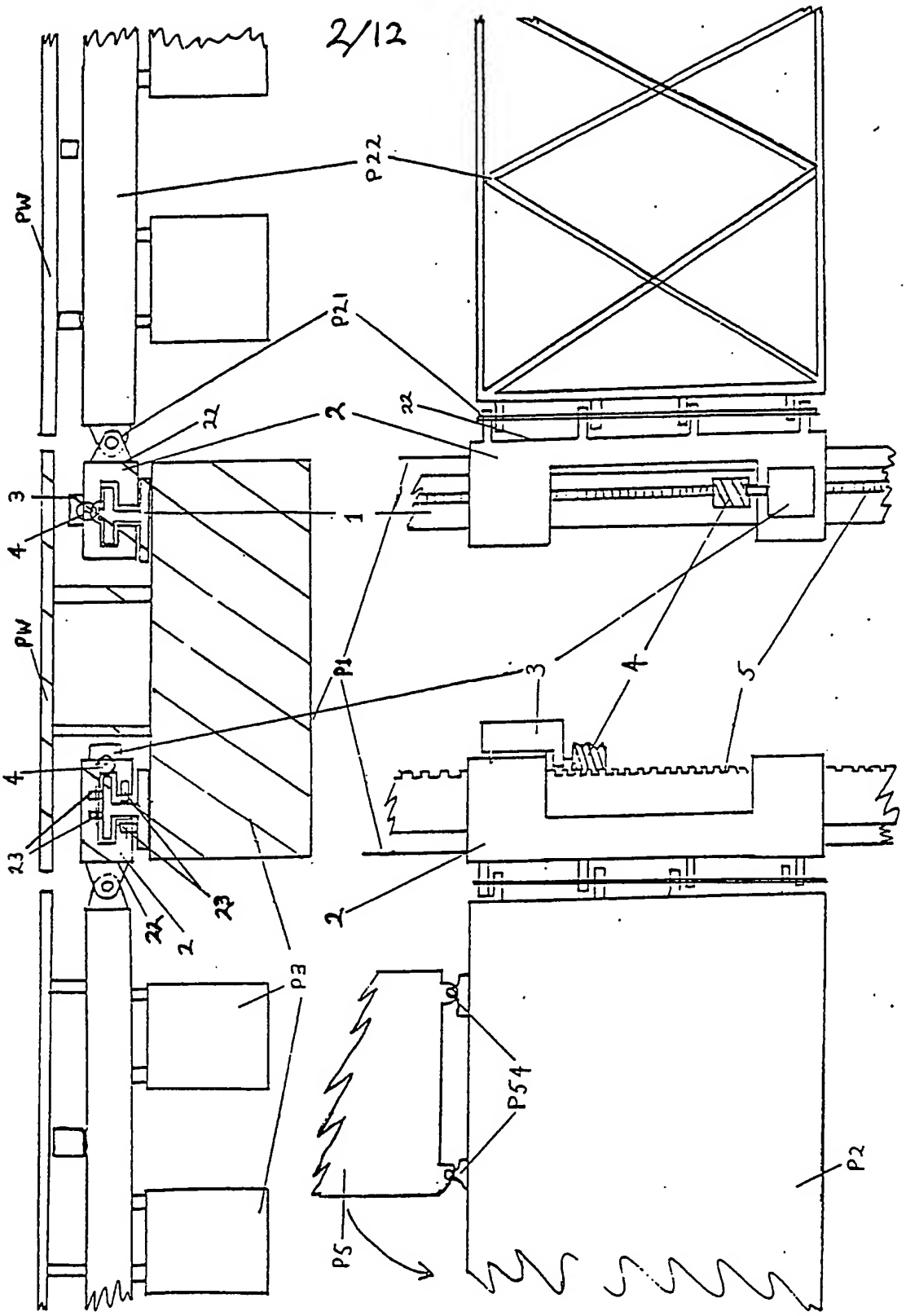


Fig 2A

Fig 2B

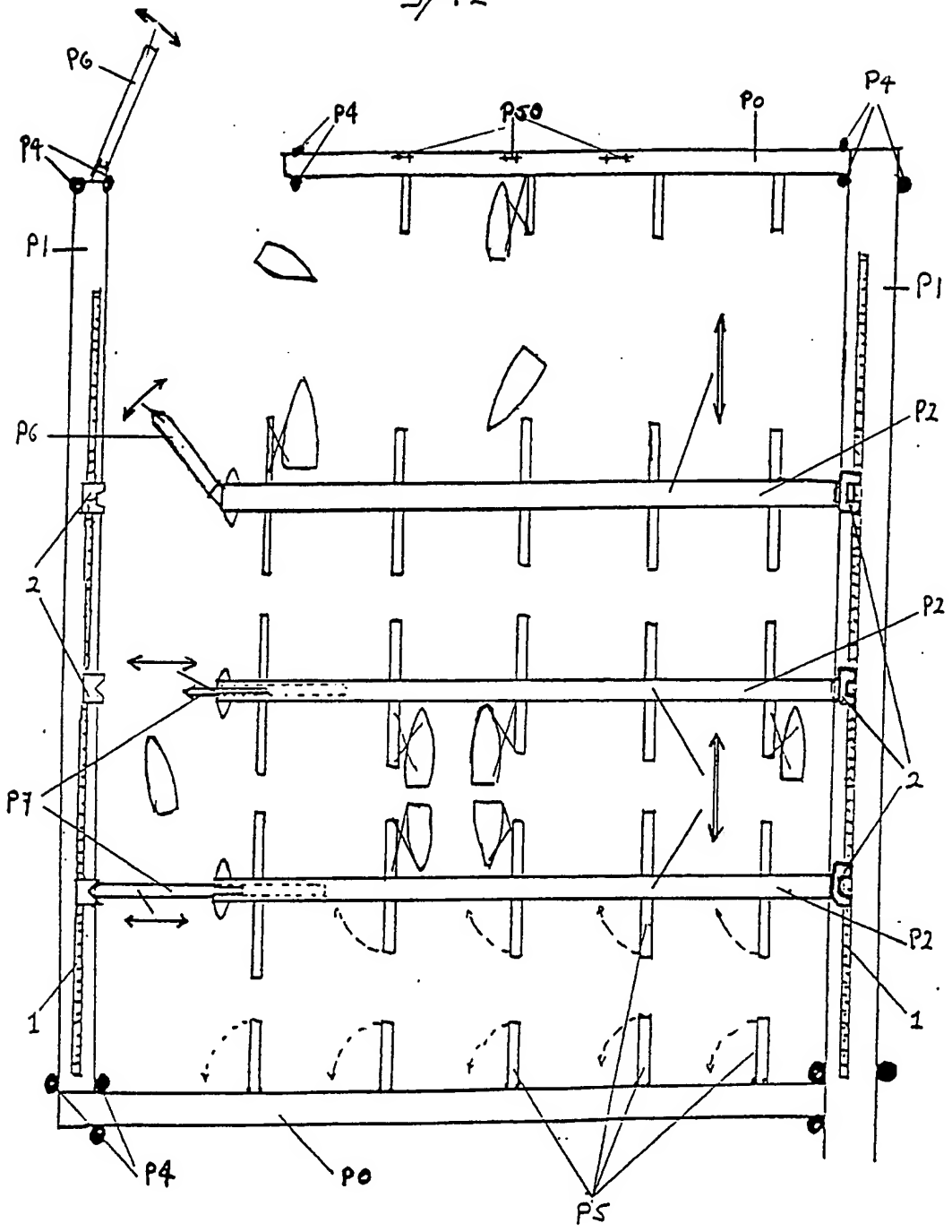


Fig 3A

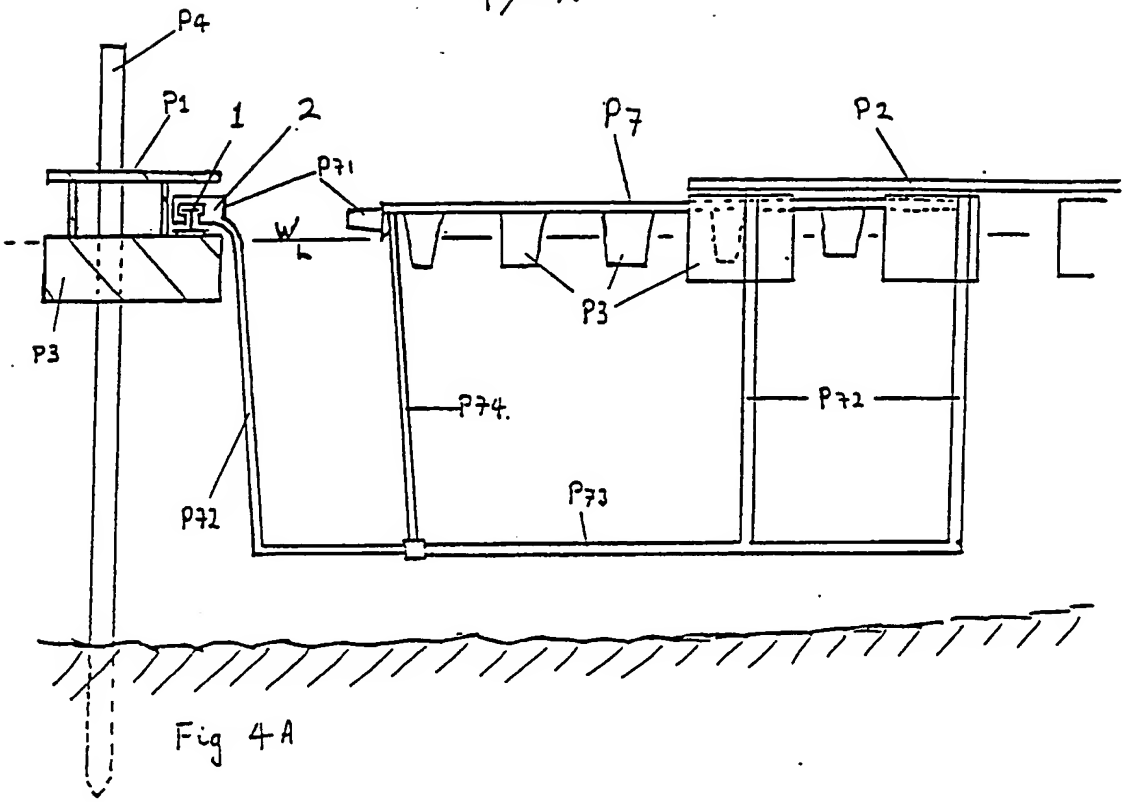

P4
P1
1
2
P71
P7
P2
W
h
P3
P3
P74.
P72
P72
P73

Fig 4A

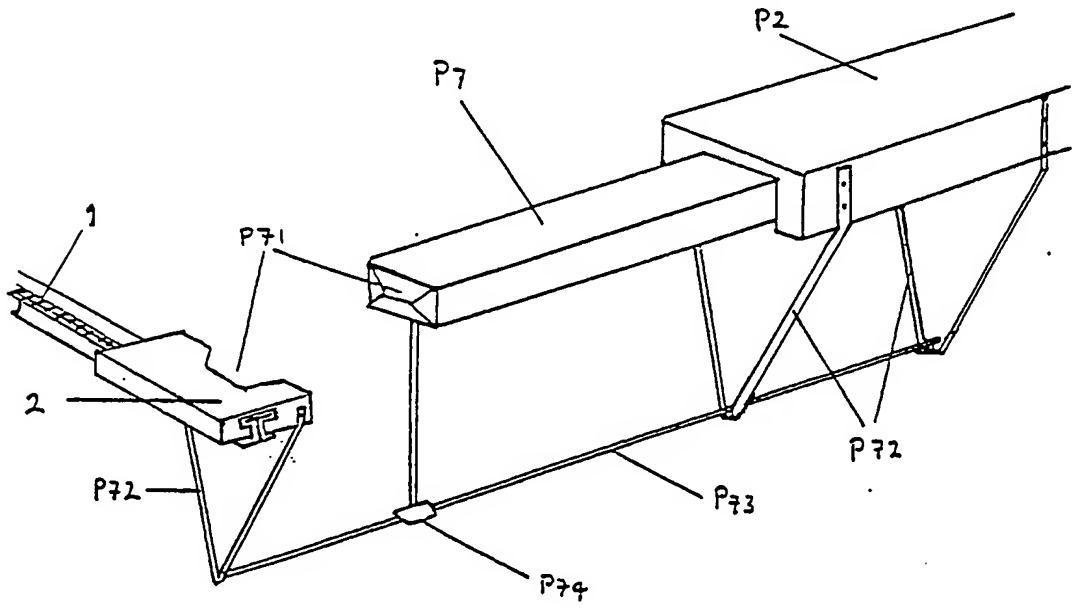

P2
P7
1
P71
2
P72
P72
P73
P74

Fig 4B

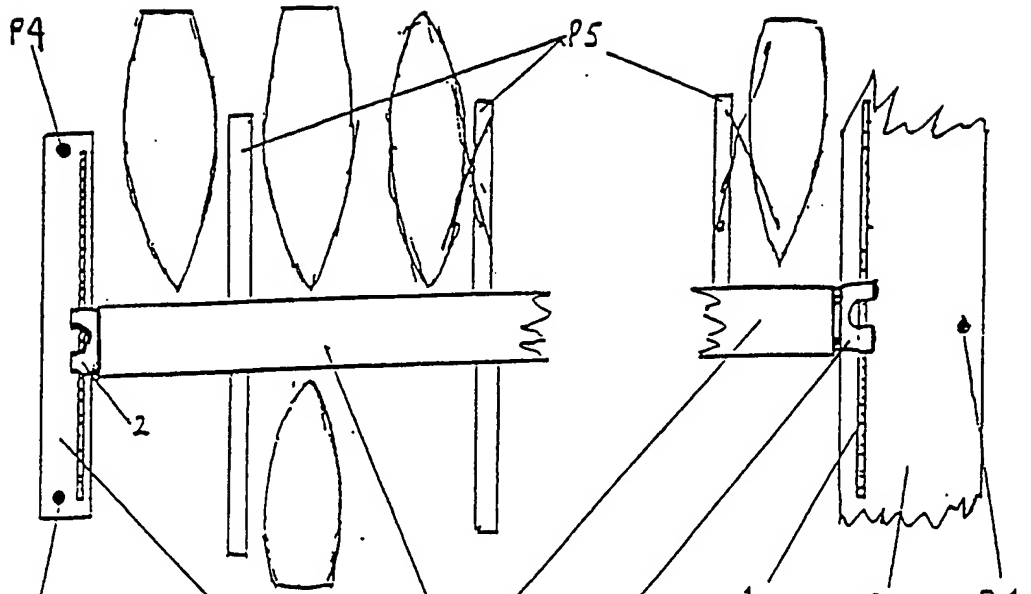


Fig 5A

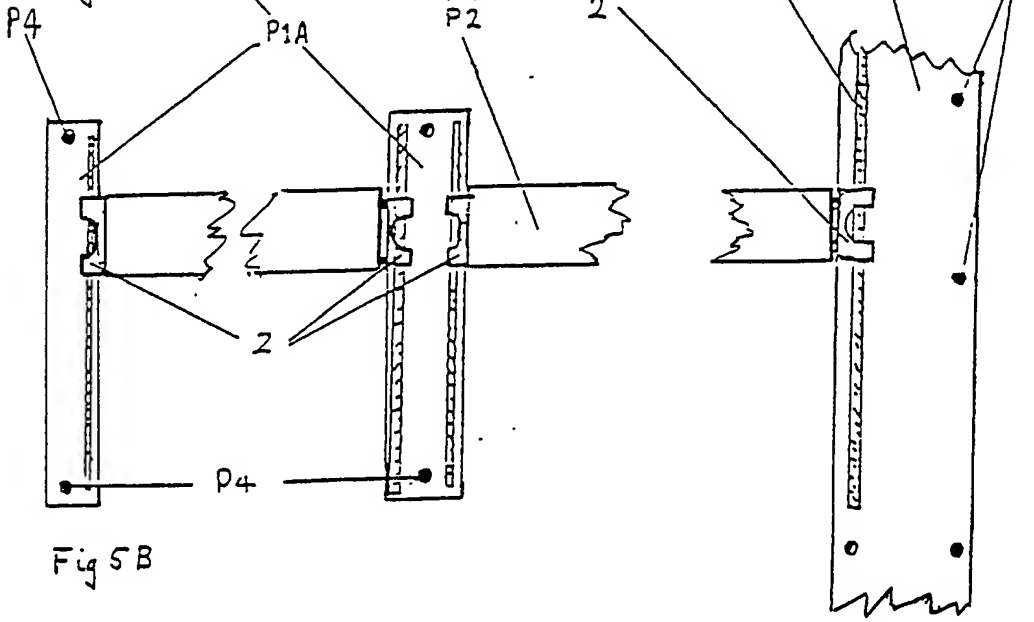
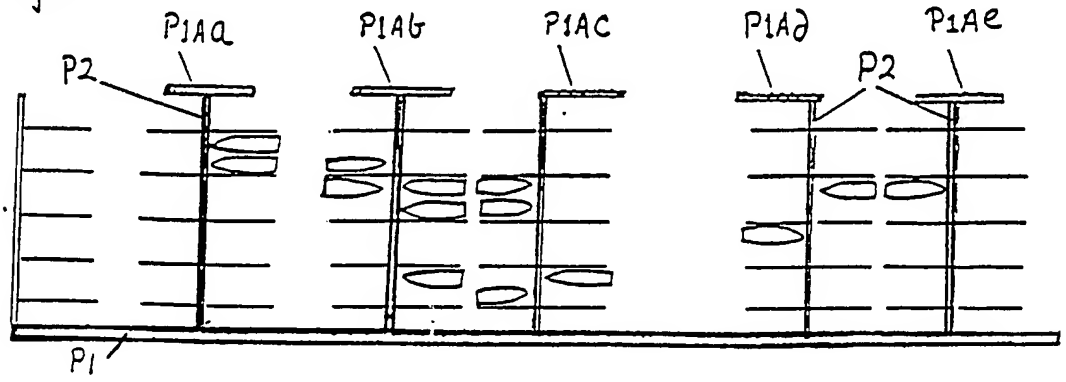


Fig 5B

Fig 5c



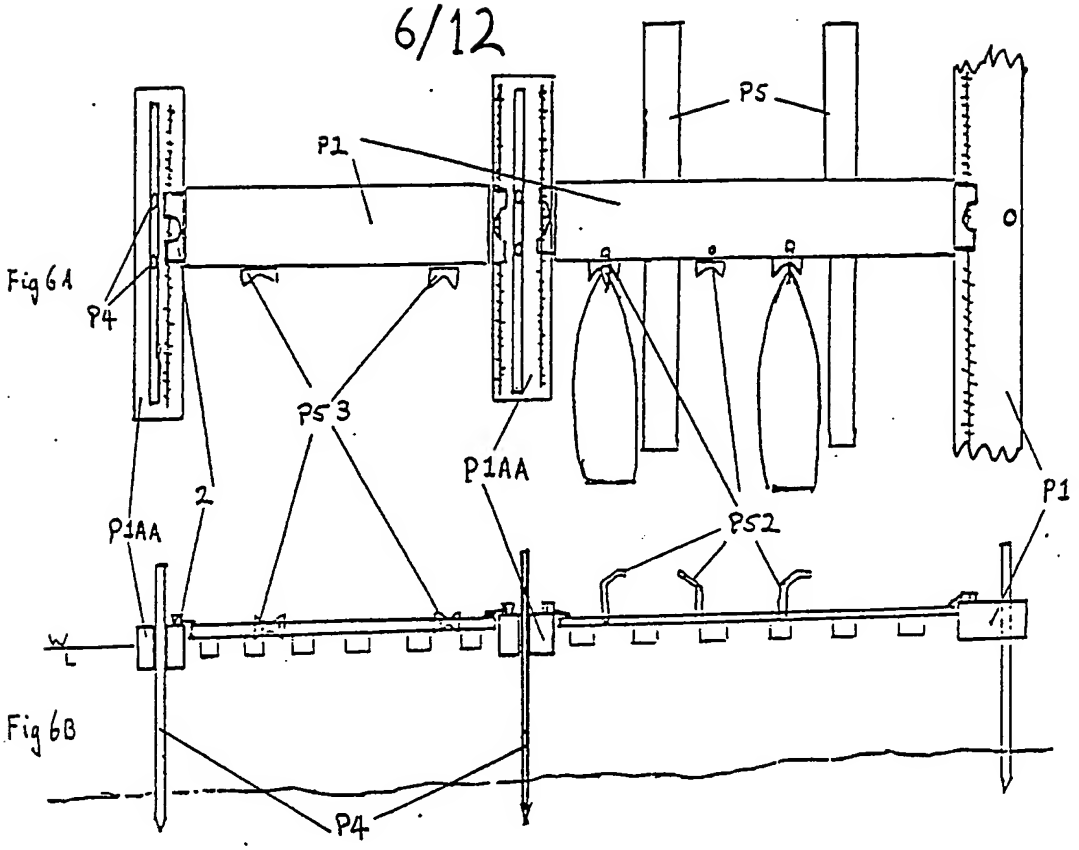


Fig 6A

Fig 6B

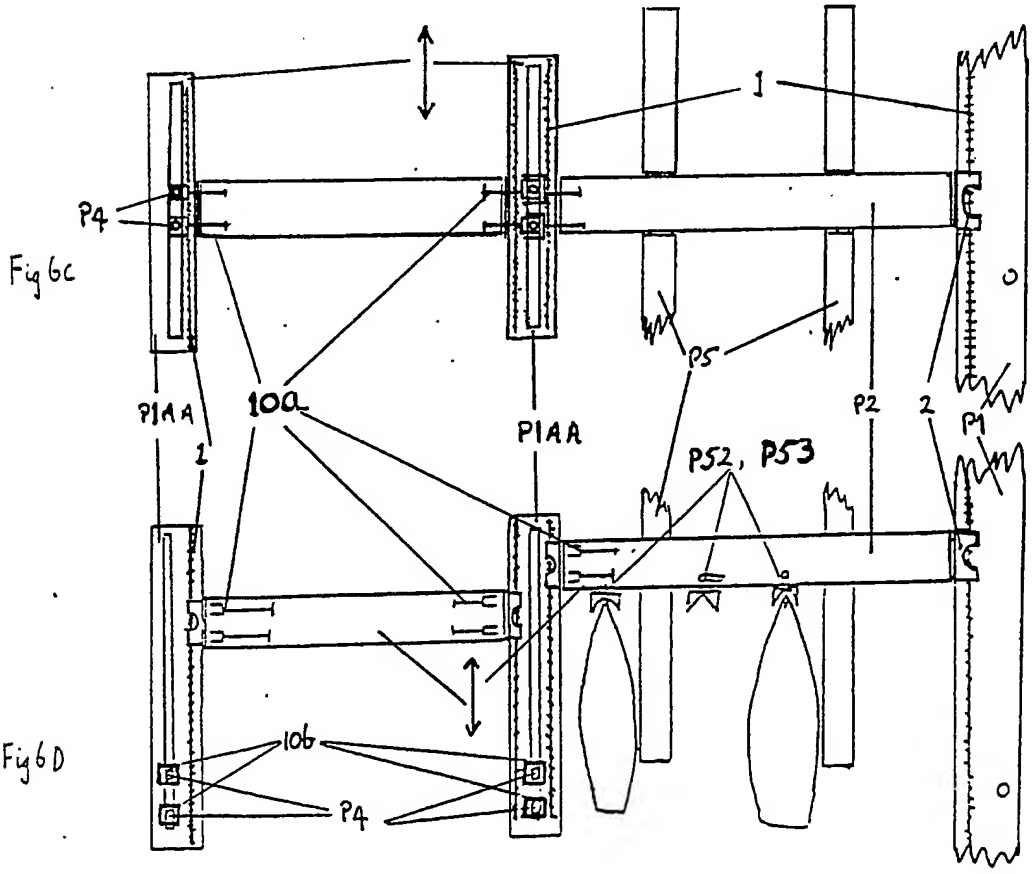


Fig 6C

Fig 6D

Fig 7A

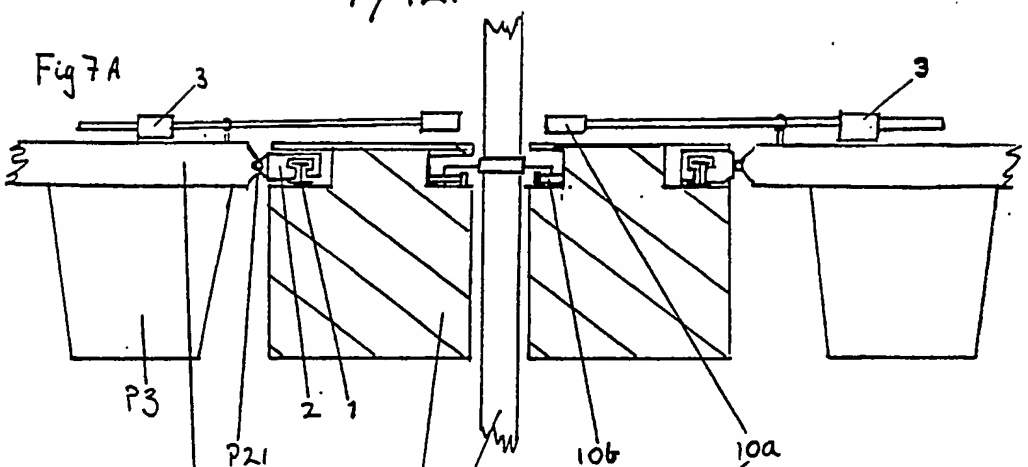


Fig 7B

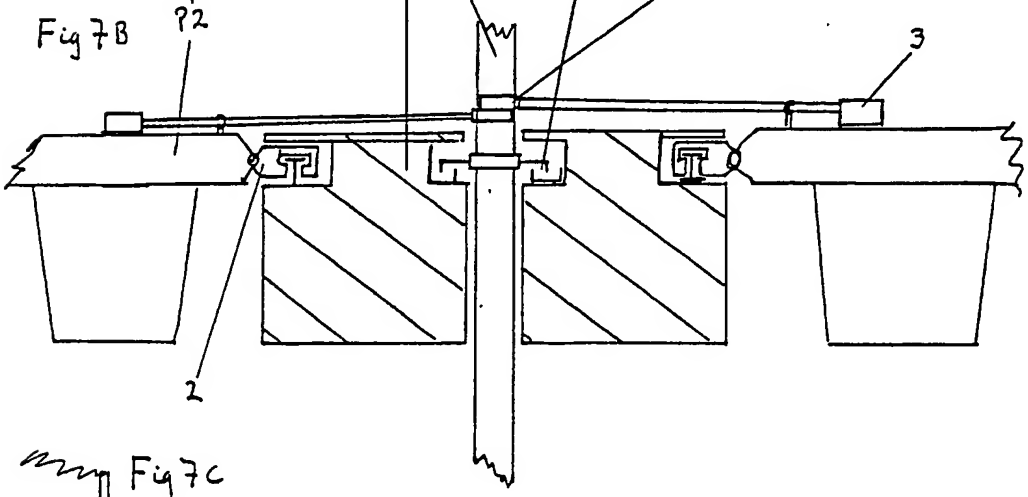


Fig 7C

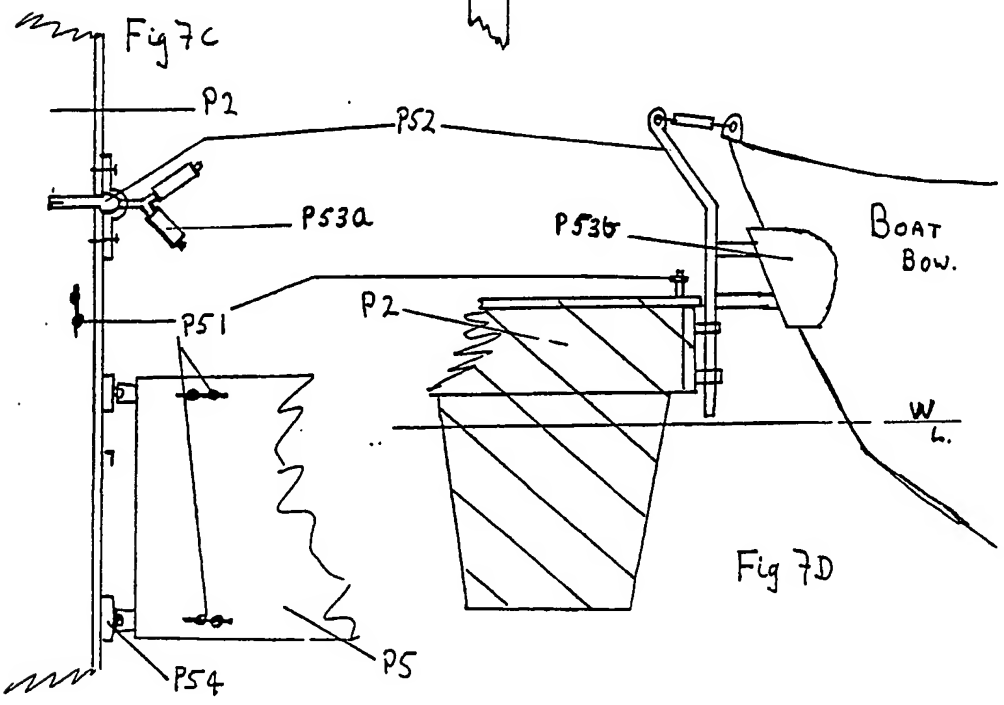
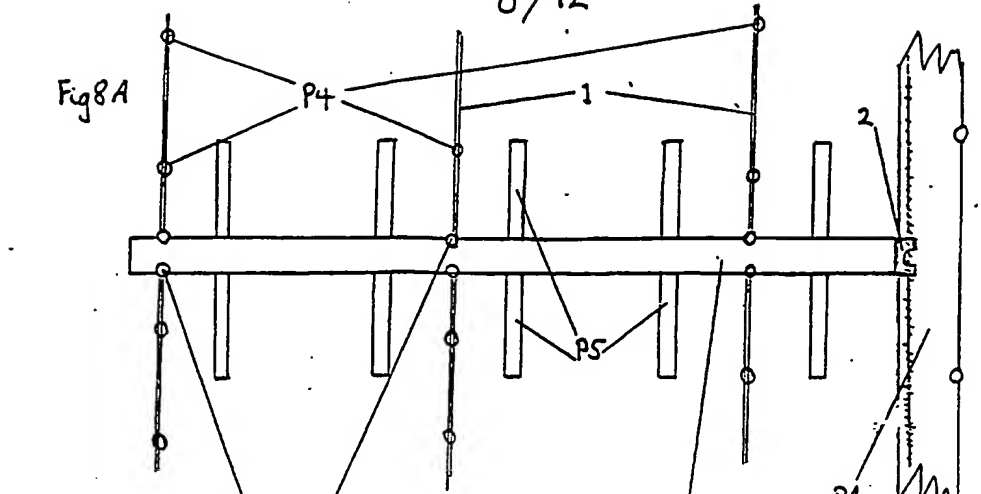


Fig 7D

Fig8A



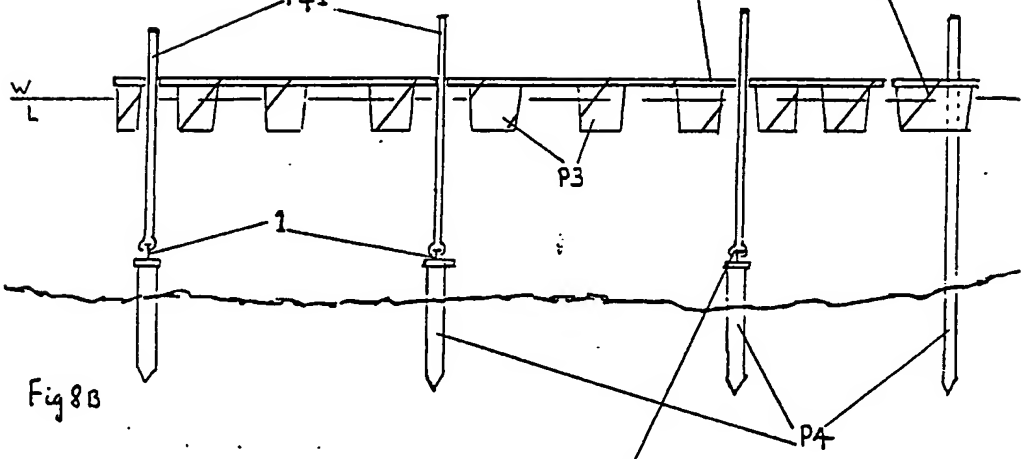


Fig8B

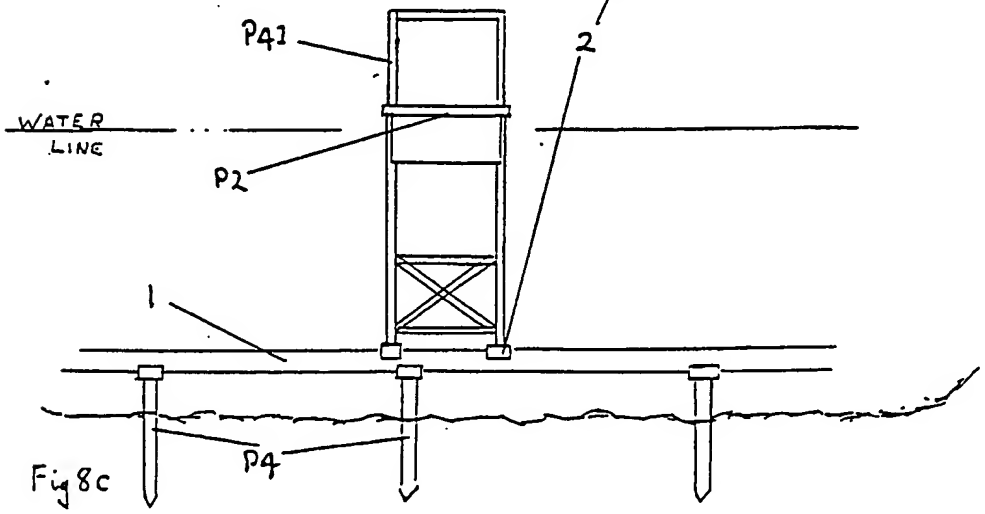


Fig8c

Fig 9A

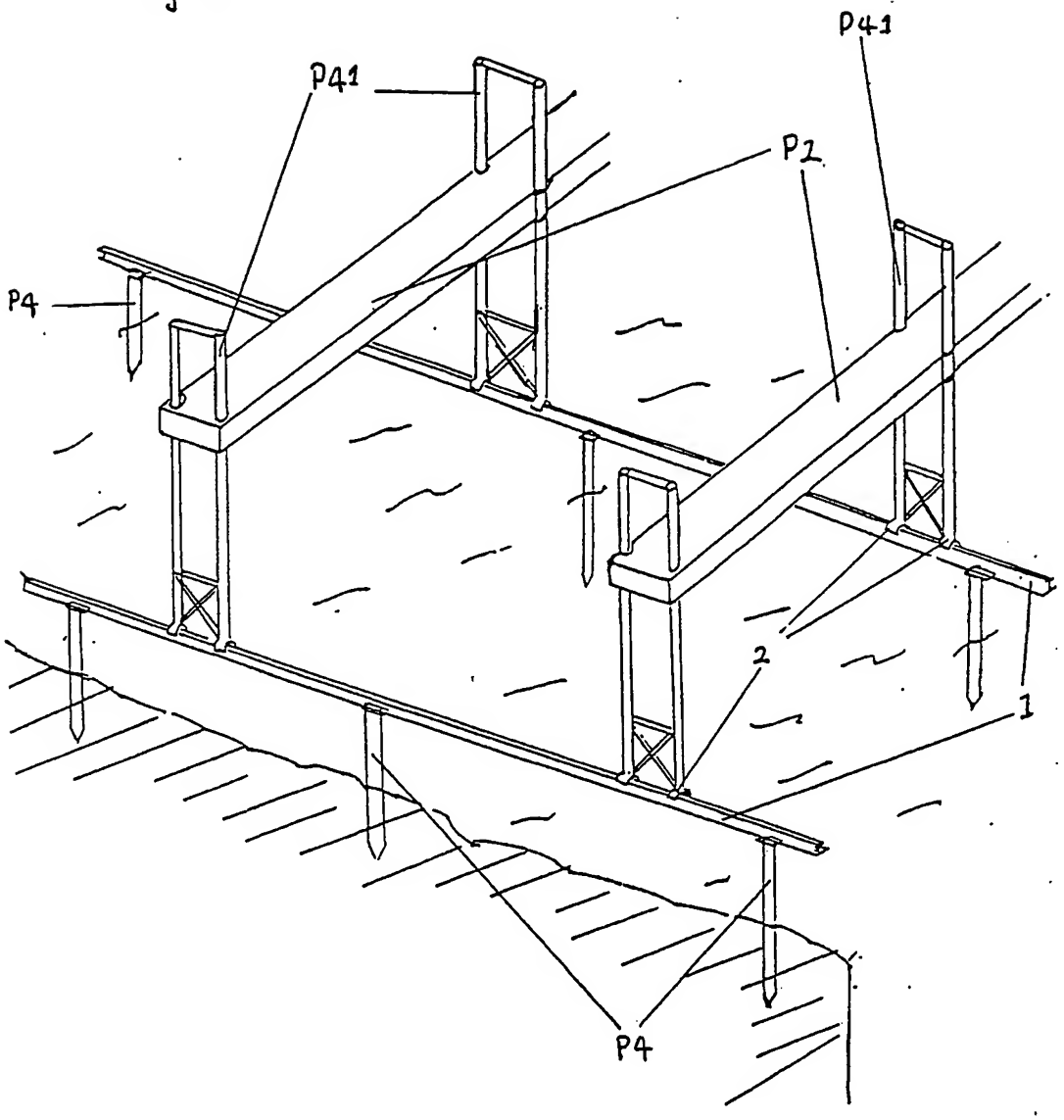
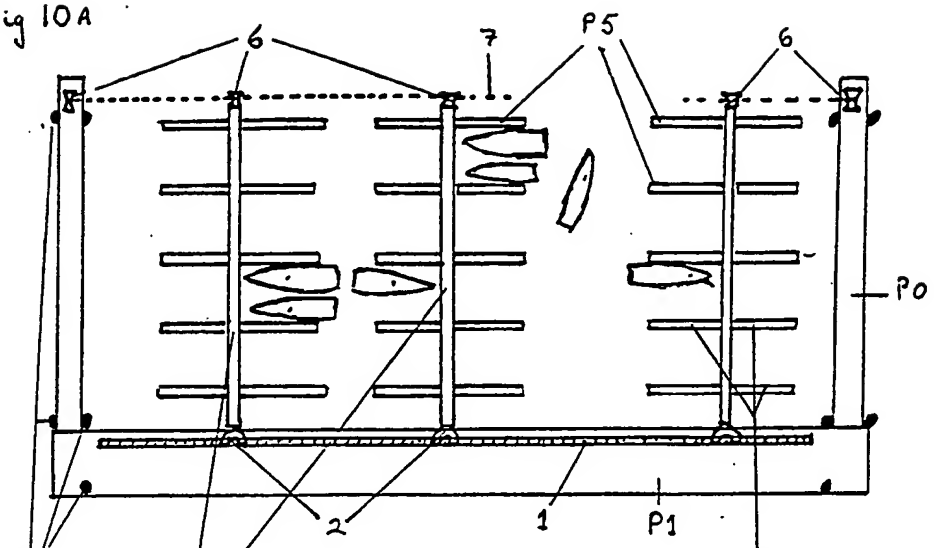


Fig 10A



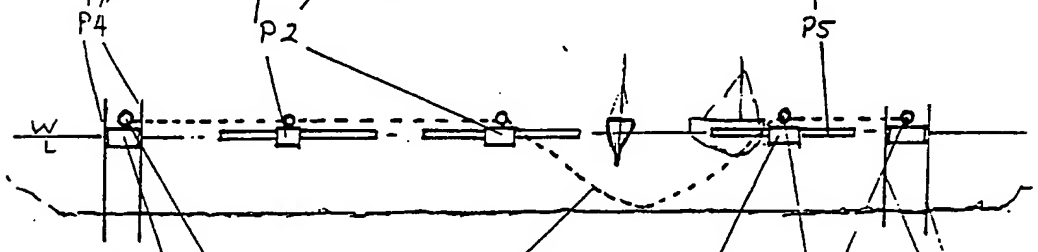


Fig 10B

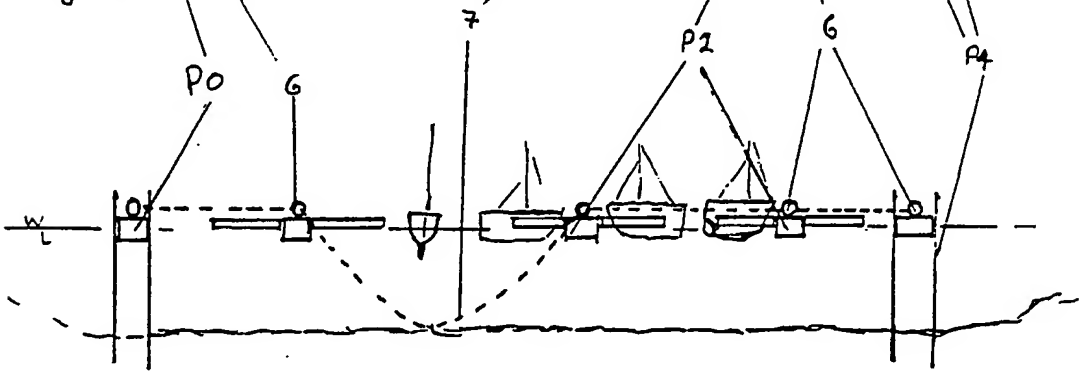


Fig 10c

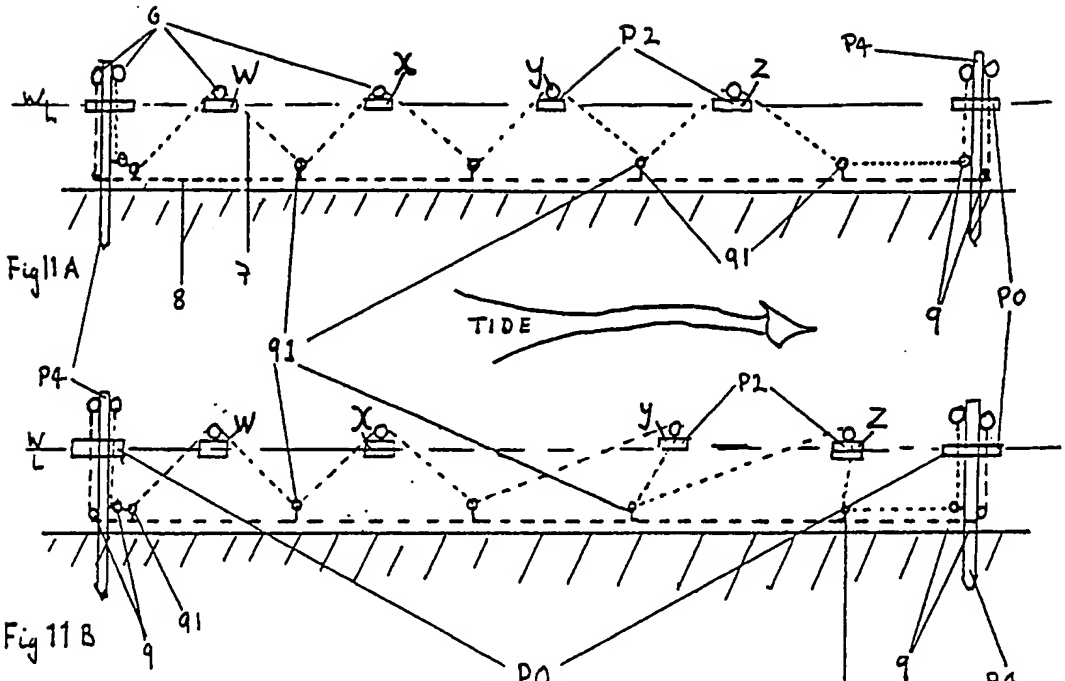


Fig 11 A

Fig 11 B

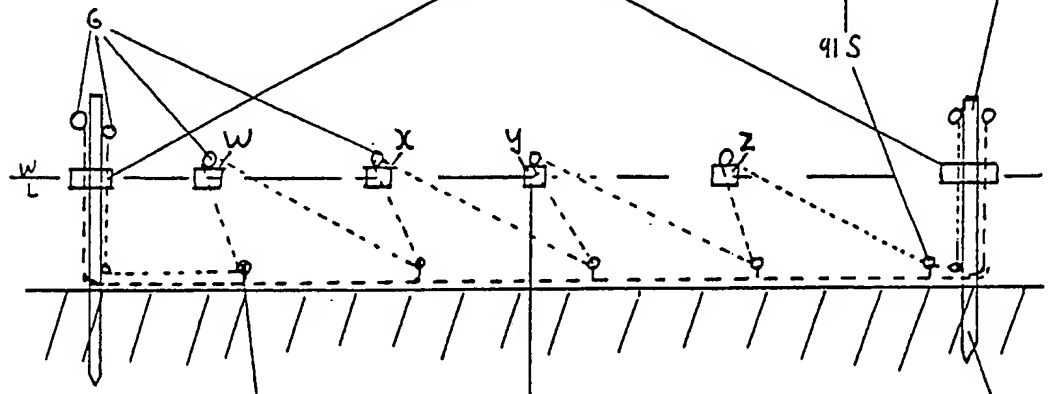


Fig 11 C

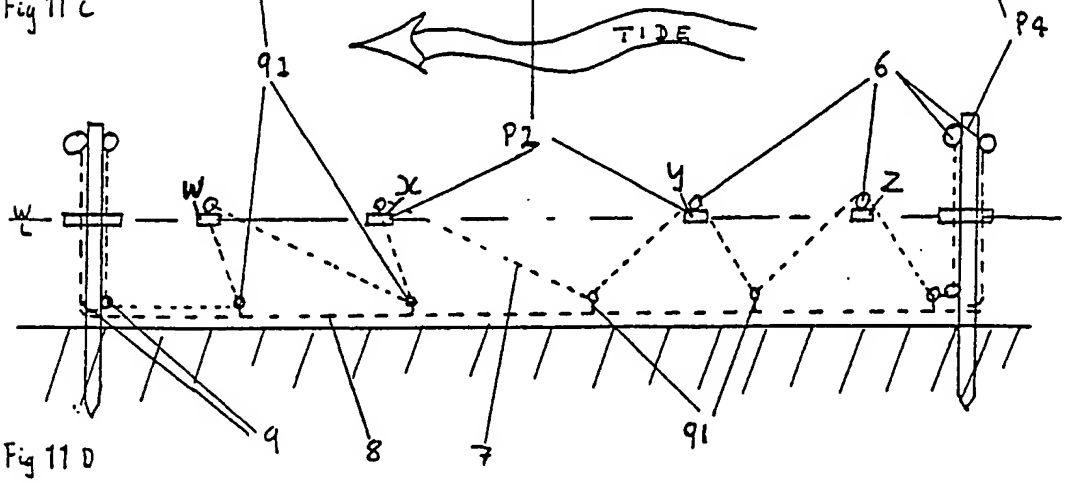


Fig 11 D

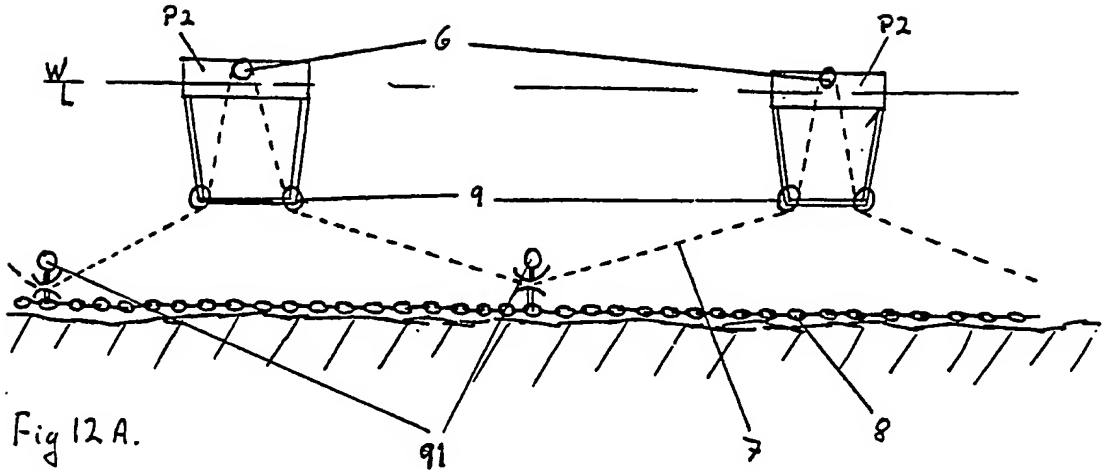


Fig 12 A.

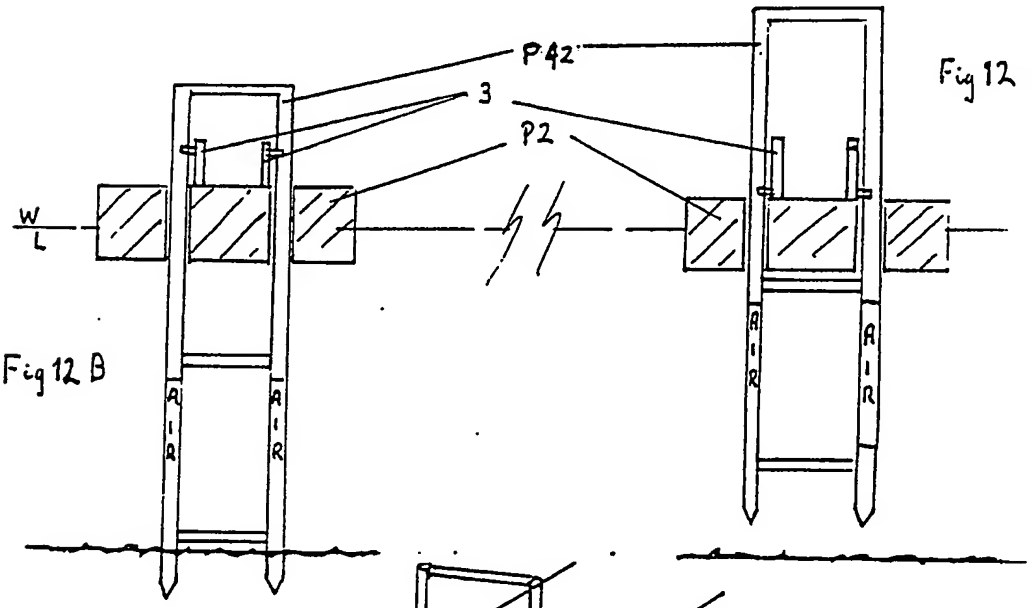


Fig 12 B

Fig 12 C

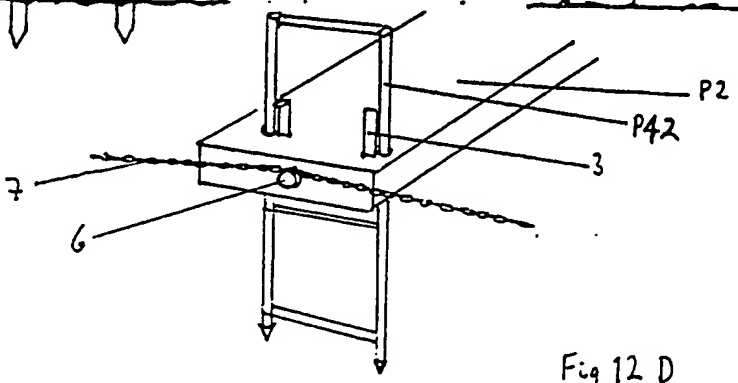


Fig 12 D

DRIVEN PONTOONS

This invention relates to forms and methods of constructing mooring or berthing facilities for boats, yachts or other floating vessels.

Boat owners and yachtsmen are familiar with the berthing facilities provided at Marinas. A marina is constructed of floating piers or pontoons with walkways on their upper surfaces. A grid pattern of main pontoons with secondary pontoons, normally off at right angles, is built up. From the secondary pontoons smaller pontoons known as finger pontoons or piers are attached at right angles to provide foot access to, and mooring points for, pairs of boats moored to the structure. An avenue or area of open water, commonly between $1^1/_2$ to 2 x the average boat's length is provided between the sterns of boats moored bow-to adjacent secondary pontoons, to allow for manoeuvring and access to and from the berths by the floating vessels. The assemblage of pontoons is commonly fixed in position by piles driven into the sea bed and while the whole structure may rise and fall with the tide, and flex to accommodate wave action, a marina, is essentially a fixed assembly in the horizontal plane.

Areas of off-shore water available for, and suited to, the construction of marinas is limited as is also the case when marinas are constructed within pre-existing docks, harbours, basins or lakes. The need to allow access avenues or areas of open water between files of berthed boats commonly means as much as 50% of the available water surface is not used for the

berthing of vessels.

Thus, where it would be desirable to provide berthing facilities for a greater number of vessels within a given area of water, or to provide an adequate number of berths in a smaller area of water, an ability to utilize more of the water surface for moored vessels, whilst retaining their ability to moor and manoeuvre marina style, would be advantageous.

According to the present invention a plurality of pontoons, to which boats or other floating vessels are moored, are contained within and are, or are, attached to a longitudinal member of another structure, which may be fixed or floating, in such a way that the pontoons with vessels moored to them may be driven, by a variety of power sources, forwards or backwards relative to each other in order to provide, when required, an area of open water between an adjacent pair of pontoons in which vessels may manoeuvre into and out of their berths. Provision is made for the pontoons with vessels moored to them to be driven from one or both ends and/or at intermediate points along their length and yet allow access to and from berths by floating vessels having due regard to their draft and height above water and currents and states of the tide. Provision is made for the movement of pontoons which are driven to be arrested in any position relative to each other and to the structure which drives them, or against which they drive, to oppose the effects of windage, tide, current or other sources of displacement. Provision is made for the secure mooring of vessels and for resilient fendering arrangements to restrict and absorb the

movement of vessels against the driven pontoon to which they are moored. Provision is made for the finger pontoons to be hinged so that the driven pontoons, without boats moored to them, may be driven close together when required.

Some specific embodiments of the invention will be described by way of examples with reference to the accompanying 12 drawings in which:

Drawing 1/12

Fig 1A Shows in plan a base pontoon with four secondary pontoons each side. The figure shows open water between adjacent pontoons on right hand side of main pontoon.

Fig 1B Perspective of shoe or wheeled carriage free to be driven along longitudinal member

Fig 1C Perspective of shoe free to be driven in longitudinal member shown as a 'C' section tube

Drawing 2/12

Fig 2A Vertical section through main pontoon showing driving shoe and connection to driven pontoon

Fig 2B Plan of assemblage of main and driven pontoons

Drawing 3/12

Fig 3A Plan of marina with driven pontoons having telescopic and/or hinged portions

Drawing 4/12

Fig 4A Vertical section of main pontoon, driving shoe and

U-shaped construction connecting to driven pontoon. Driven pontoon having extendable or telescopic portion.

Fig 4B Perspective of arrangement shown in Fig 4A

Drawing 5/12

Fig 5A Plan of driven pontoon. Right hand end driven along continuous main pontoon. Left hand end driven along short section of main pontoon.

Fig 5B Plan of driven pontoon as in Fig 5A but including a short section of main pontoon in intermediate position

Fig 5C Schematic plan of arrangement of short section main pontoons relative to continuous main pontoon

Drawing 6/12

Fig 6A Plan of short section main pontoons with slots for piles. Driven pontoons with mooring posts and fendering arrangements.

Fig 6B Vertical section of Fig 6A

Fig 6C Plan of pontoons. Driven pontoons secured to piles. Short section pontoons may be driven

Fig 6D Plan of pontoons. Short section main pontoons secured to piles. Driven or secondary pontoon may be driven

Drawing 7/12

Fig 7A Vertical section through short section main pontoon with slot shown clamped to piles. Driven pontoon

free to move

Fig 7B As Fig 7A yet driven pontoons clamped to piles. Short section main pontoon released and free to move.

Fig 7C Plan of arrangement of mooring post and bow fender, other mooring points and hinged finger pier.

Fig 7D Vertical section through driven pontoon showing mooring post and bow fender in relation to the bows of a moored boat

Drawing 8/12

Fig 8A Plan of driven pontoon with finger piers. Driven at right hand end along main pontoon. but at left hand end and at intermediate points, driven along longitudinal member, affixed by piles above sea bed

Fig 8B Vertical section of Fig 8A showing underwater longitudinal rail on fixed piles and shoe and mobile piles extending above water surface and secured to driven pontoons.

Fig 8C Vertical end or cross section of Fig 8A

Drawing 9/12

Fig 9A Perspective of arrangement of driven pontoons, fixed under water rail and mobile piles as shown in drawing no. 8/12

Drawing 10/12

Fig 10A Plan of marina showing pontoons driven by chain and chain winches.

Fig 10B Vertical end view of Fig 10A showing bight of chain

lowered to sea bed to allow access to craft.

Fig 10C As Fig 10B but with bight of chain in new position.

Drawing 11/12

Fig 11A Schematic end view of marina with four driven pontoons showing arrangement of chains and winches on pontoons and piles and 'lacing' arrangement to ground chain. Access between pontoon 'Z' and right hand pontoon

Fig 11B As Fig 11A, access now between pontoons 'X' and 'Y'.

Fig 11C As Fig 11A except direction of tide, current, reversed and ground chain moved to right. Access between pontoon 2 and right hand pontoon

Fig 11D As Fig 11C access now between pontoons X and Y

Drawing 12/12

Fig 12A End view or cross section of driven pontoons and A-frame structure.

Fig 12B Cross section of driven pontoon raised up. relocatable pile pushed into sea bed

Fig 12C As Fig 12B but buoyancy of driven pontoon has removed relocatable pile from sea bed

Fig 12D Perspective of arrangement of relocatable piles in relation to chain driving winch and chain.

Referring to drawing 1/12 Fig 1A a main or driving pontoon P1 is secured by piles P4 at right angles to a shoreline or pontoon PO. Secondary or driven pontoons P2 and referred to as W,X,Y and Z are attached at right angles to the driving pontoon P1 with smaller finger pontoons P5 off providing mooring bays for floating vessels.

Ends of the driven pontoons P2 are attached to the main pontoon P1 via a sliding shoe, sledge or wheeled car 2. Two examples of sliding shoes 2 may be seen in perspective by referring to Figs 1B and 1C. In Fig 1B the longitudinal member 1 is shown as an 'I' beam and in Fig 1C as a 'C' section tube. In both examples the shoe 2 is constructed to have surfaces that conform to the shape of the member 1 so that the shoe 2 is located and held in position yet is free to move along the longitudinal member 1. To propel the shoe 2 along the member 1 a variety of power sources may be envisaged including cable or chain releasably attached to the shoe 2 and running parallel and adjacent to the member 1 (not shown) or cable or chain attached to the driven pontoon P2 (see drawings 10 and 11/12) or by hydraulic rams bearing on the shoe 2 and attached to the member 1 or main pontoon P1 (not shown) or as shown in Figs 1B and 1C by means of a motor 3 attached to shoe 2 driving a worm or pinion gear 4 along a rack 5 which may be integral to member 1.

In Fig 1A the driven pontoons P2, W,X,Y and Z on the left hand side of the driving pontoon P1 are shown spaced too closely for boats to manoeuvre into and out of their berths. On the right hand side of Fig 1A driven pontoons P2, W, X and Y are shown to have moved in the direction of the arrow ⟶ creating

access between driven pontoons P2 Y and P2 Z in which boats may manoeuvre.

The longitudinal member 1 which accepts the driven shoe 2 is shown in Fig 1A extending to the full length of the driving pontoon P1 and in this and other embodiments is envisaged as a structural member of the pontoon P1. The driven pontoons P2 are secured and driven at their 'inboard' end by connection to the shoe 2. At intermediate points (not shown) and at their 'outboard' ends the driven pontoons P2 may have water propulsion units such as propellers or water jets 33 mounted to assist in driving the pontoons P2 and in maintaining their positions relative to each other and to the driving pontoon P1.

The finger pontoons P5 on driven pontoon P2 X on left side of Fig 1A are shown as having an ability to hinge in the direction of the arrows. With no vessels moored all finger pontoons P5 may be folded against their respective driven pontoons P2 and the resulting assemblage may be driven together, for example in the direction of the shoreline or pontoon PO.

Drawing 2/12 shows in greater detail the components schematically represented in Figs 1B and 1C. In Fig 2A the longitudinal members 1 of the driving pontoon P1 may be attached to the pontoon floats P3 with a pedestrian walkway PW supported above them. The longitudinal member 1 may be as shown as an 'I' beam. On the left hand side of Fig 2A the member 1 has on one of its flanges, a rack gear 5 in which a worm gear 4 engages and is driven by motor 3 which is secured to a wheeled 23 shoe or or sliding sledge 2. The shoe 2 presents at the outboard edge of

the driving pontoon P1 a surface 22 to which the driven pontoon P2 is attached. In the embodiment described here a hinge arrangement P21 is shown. On the right side of Fig 2A the longitudinal member 1 of the driving pontoon P1 is shown as an 'I' beam with a rack gear 5 on its upper surface. The sliding shoe 2 is driven via worm 4 and motor 3 as described above.

The structure of the driven pontoons P2 is shown as essentially an 'I' beam laid on its side having two longitudinal members and strutting or webbing P22. Pontoon floats P3 are attached to this member P22 and a pedestrian walkway PW is provided above.

Fig 2B is a plan view of the arrangement described above except that on the left side of the figure the semi-articulate, demountable fixing and hinge P54 of a finger pontoon P5 is shown with arrow ↙ indicating its folding action.

The driving pontoon P1 may be built up of modular lengths joined by semi-articulate connections to allow for wave flexing. The ends of longitudinal members 1 are therefore adjacent to each other on their respective pontoons but are not continuous. To facilitate the transferring of the driven shoe 2 from one length of member 1 to the next the throat of the driven shoe 2 may be splayed or radiused to accommodate differences in alignment between the adjacent ends of longitudinal members 1 (not shown).

Referring to drawing 3/12 Fig 3A shows a plan of a marina module with three driven pontoons P2, with finger piers P5, capable of being driven in direction of arrow ⟺ along two

driving pontoons P1 each having a longitudinal member 1 and driving shoes 2. The positions of the driving pontoons P1 are fixed by piles P4 as are pontoons P 0. Of the three driven pontoons P2 two are shown with telescopic sections P7 and one variant with a hinged section P6. The entrance to the marina module is shown controlled by a similar hinged section P6. These sections may move in the direction of the arrows ↖↘. Mooring points P50 are provided outside the marina module for marshalling waiting craft.

The section of the driven pontoon that is telescopic P7 or hinged P6 may be releasably locked onto the driving shoes 2 on the left of Fig 3A by for example hydraulically driven bolts or catches (not shown) where upon the driven pontoons P2 with boats moored to them may be driven from both ends simultaneously. With the driven pontoons P2 in their desired position for vessels to leave or enter their berths in the marina, the telescopic P7 or hinged P6 sections of the required driven pontoons P2 may be disengaged from the driving shoes 2 on pontoon P1 on left of Fig 34 and withdrawn or open to allow passage. The mechanical arrangements for moving sections P 6 and P7 are not shown, but hydraulic rams or a system of driven cables mounted under the walkways of the driven pontoons P2 is envisaged.

The provision of a second longitudinal member 1 on either or both driving pontoons P1, as shown in drawing 2/12, may enable a number of such marina modules shown in Fig 3A to be assembled side by side. Within a pre-existing fixed structure such as a dock the longitudinal members 1 may be fixed to the

walls of such a dock with an extendable hinge arrangement (not shown) between the driving shoes 2 and the driven pontoons P2.

In the embodiment shown in Fig 3A the finger piers P5 are hinged and may be folded in the direction shown by arrows ,,'' in order that the three driven pontoons P2 with finger piers P5 folded, may be driven together to form a platform area or for maintenance e.g. dredging or for over wintering.

In drawing 4/12 Fig 4A an example of the construction of an extending or telescopic section P7 of the driven pontoons P2 seen in Fig 3A is shown. Referring to Fig 4A the driving pontoon P1, secured to the sea bed by pile P4, has rail 1 and driving shoe 2 as shown in drawing 2/12 save that the outboard edge of the shoe 2 is modified to include one or more vertical members P72 that extend below the water surface to a depth exceeding that of the draught of vessels using the marina. At the required depth the vertical members P72 connect to one or more horizontal members P73 which extend beneath the non-telescopic portion of the driven pontoon P2 and to which it is connected by one or more vertical members P72, shown in Fig 4A as an 'A' frame.

Construction of these members P72 and P73 may be tubular with such ballast or buoyancy compartments as are required to achieve neutral buoyancy for the assembly. Where for example this 'U' shaped link between the driving shoe 2 and driven pontoon P2 is considered insufficient to transmit the driving forces required to move the pontoon P2 with boats moored to it, the telescopic section P7 of the driven pontoon may be connected

to the horizontal member P73 by a vertical member and shoe P74 in order that when it is driven out of the pontoon P2, by means for example of an hydraulic ram (not shown), it may reliably connect with the driven shoe 2 whose outboard surface is also modified to provide a releasable locking mechanism P71 between the shoe 2 and the pontoon P2. An unextended portion of the telescopic section P7 remains within the structure of the driven pontoon P2 located by guide channels (not shown) and along which it may slide in and out, so that the essential 'I' beam structure of driven pontoon P2 may be continuous across the width of the marina (shown in Fig 3A) to transmit the forces applied by the driving shoes 2 at each end of the pontoon P2.

Fig 4B shows the schematic perspective of the arrangement described above.

An alternative means (not shown by diagram) of linking the opening end of the pontoon P2 (see Figs 3A and 4A and 4B) may be by a drawbridge or counter balanced beam arrangement mounted on either the end of the pontoon P2 or the driving shoe 2. In operation the 'bridge' may be released and raised into the vertical position to allow passage of craft and then be lowered to the horizontal and secured to create a link between the driving shoe 2 and the pontoon P2 and transmit the forces to move the pontoon P2.

An embodiment of the principals of marinas with driven pontoons is shown in drawing 5/12. Referring to Fig 5A the driven pontoon P2 is shown driven at its right hand end along a continuous driving pontoon P1 which is secured by piles P4. The

other end of the driven pontoon P2 may be driven forwards and backwards along a short section of main pontoon P1A which is also secured by piles P4. Fig 5B shows the same arrangement but with the addition of an intermediate short section main pontoon P1A, necessary for example when the overall length of the driven pontoon P2 is too great to be driven as one section.

Referring to Fig 5C a schematic arrangement of five short section driving pontoons P1Aa to P1Ae is shown in relation to a continuous main pontoon P1. Between the sterns of boats moored bow-to the pontoons P2 and driven by the short section main pontoons P1Aa and P1Ab there is an area of open water insufficient for boat ⊃ handling. Between pontoons P2 driven from short section main pontoons P1Ac and P1Ad an adequate area of open water for manoeuvring is achieved by driving the pontoons P2 to the left and right hand extremities of the short section pontoons P1Ac and P1Ad respectively; which is achieved at the expense of the open water which did exist between P1Ab and P1Ac and P1Ad and P1Ae. Reversing and altering the sequence of opening and closing the gaps of open water between the files of moored vessels may allow access by craft to and from all berths in the marina.

In the arrangement of fixed short section main pontoons P1A shown in Figs 5A, 5B and 5C the ability to position all the driven pontoons P2 together may not be available, although as a result of their mobility, operations such as dredging are facilitated. To retain fully the ability to group driven pontoons P2 together it may be that the short section main

pontoons are constructed in the manner shown in drawing 6/12.

Referring to Fig 6A, the short section driving pontoons P1AA are constructed with a slot or channel, which may be central, so that the pontoon P1AA as well as rising and falling vertically against the piles P4 that secure it, may be driven in a horizontal direction relative to the piles P4 restrained by means of the slot or channel through which the piles P4 protrude. Fig 6B shows a vertical section of the arrangement.

For operation two sets of releasable clamps 10 are required, one set 10a may be mounted on the driven pontoon P2 such that they may clamp the driven pontoons P2 to the piles P4. Referring to Fig 6C with pontoons P2 clamped to piles P4 by means of clamps 10a operation of the shoe 2 will move the unclamped short section main pontoon P1AA in the direction of the arrow ⟷ to the extent allowed by the slot. The second set of releasable clamping mechanisms 10b may be mounted as shown in Fig 6D to the short section main pontoon P1AA or on the piles P4. In operation the clamps 10b hold the short section main pontoon P1AA to the piles P4 and operating the driving shoe 2 with the clamps 10a previously holding the pontoon P2 to the piles P4 now released the driven pontoon P2 is moved in the desired direction shown by arrow ⟷ in Fig 6D. Adjacent pontoons P1AA may be driven towards each other and be of such a length that their ends may come into contact where upon the driving shoe 2 may be transferred to the longitudinal member 1 of the next pontoon P1AA and by this means all driven pontoons P2 may be grouped together.

In drawing 7/12 Figs 7A and 7B demonstrate an arrangement of the clamps described above. Fig 7A the releasable clamp mechanisms 10a mounted on the driven pontoons P2 are shown in the released position under the control of motor 3. The releasable clamps 10b between the short section main pontoon with slot P1AA and the piles P4 are shown in the secured position. In this configuration the driven pontoons P2 may be driven via the driving shoe 2 along the longitudinal member 1.

Referring to Fig 7B the clamp on arrangements are reversed. The clamps 10a on the driven pontoons P2 are in the secured position while the clamps 10b between pontoon P1AA and the piles are released. Operation of the driving shoe 2 will now move the pontoon P1AA as described above with reference to Figs 6C and 6D.

In all embodiments of driven or mobile pontoons it is envisaged that boats moored to the pontoons will be subjected to more frequent reversals of strain on their mooring points than may be experienced solely as a result of changes in wind, tide or current.

Referring to Figs 6A and 6B regarding position and Figs 7C plan and 7D section for detail, a stem head mooring post P52 may be provided adjustably secured to the outboard surface of the driven pontoon P2. The mooring post P52 may be contoured to the shape of the bows of boats and comprises in essence a post and a resilient detachable fixing between the post and the stem head fittings of the craft concerned.

A bow fender P53 comprising pneumatic rollers in a 'Y'

configuration P53a or an appropriately moulded fender P53b may be adjustably fixed to the mooring post P52 or to the driven pontoon P2. These two elements, P52 and P53 in conjunction or separately may transfer stresses incurred in moving the moored boats directly to the driven pontoon P2. Provision is made in addition for conventional bow and stern line mooring points or cleats P51 as required to keep the craft alongside the finger piers P5.

Referring to drawings 8/12 and 9/12, a further embodiment of driven pontoons is envisaged. In Fig 8A a plan view of a driven pontoon P2 shows, on right of figure, that it may be attached and driven by means already described i.e. a shoe 2 along a main pontoon P1. At points along its length, the driven pontoon P2 is located by and driven along submerged longitudinal members 1 which are held at or above sea or lake bed level by piles P4 driven into the said bed.

Referring to Fig 8B showing a vertical section and Fig 8C an end view of the arrangement, the driven pontoon P2 is connected to the submerged member 1 by a mobile pile P41. Thus the pontoon P2 may rise and fall, with for example tidal changes, yet is otherwise secured in position by the mobile pile P41 which is held by shoes 2 to the rail or longitudinal member 1. The mobile pile P41 is free to slide along the member 1 by the application of motive power, for example a submerged hydraulic motor which may be part of the shoe 2 or for example by cable or chain running parallel to the member 1 or by similar means (not shown). The depth of the longitudinal member 1

beneath the lowest water level exceeds the draught of vessels using the marina so their passage is unimpeded by the underwater construction.

Referring to Fig 9A in drawing 9/12, a perspective of driven pontoons P2 with a fixed underwater rail or rails 1 and mobile piles P41 is shown. In the construction of the mobile piles P41 ballast or buoyancy compartments may be included as required (not shown).

An embodiment is envisaged in drawing 10/12 whereby the mobile pontoons are driven at one end by cable or chain. Referring to Fig 10A a plan of a marina having three driven pontoons P2 is shown. At the foot of the figure the driven pontoons are driven by shoes 2 along member 1 of the main pontoon P1 secured by piles P4. To left and right of the figure two pontoons PO, also secured by piles P4, extend at right angles from the main pontoon P1 having at their other ends, which are co-terminus with the driven pontoons P2, chain or cable winches 6. Similar winches 6 are mounted at the ends of the driven pontoons P2 and a chain or cable 7 links all the winches together.

Referring to Figs 10B and 10C which show a vertical end view of the driven pontoons P2, pontoons PO, winches 6 and piles P4, it is seen that Fig 10B relates directly to Fig 10A in that a manoeuvring gap for craft exists between the middle driven pontoon P2 and the right hand driven pontoon P2. In Fig 10B a bight of chain 7 is shown lowered to the sea bed between these two pontoons to allow access by craft.

Comparing Fig 10B and Fig 10C the middle driven pontoon P2 has moved to the right and access is now available between this pontoon and the left hand driven pontoon P2. To achieve this position the winches 6 on the right hand pontoon PO and the right hand driven pontoon P2 may be operated in unison to draw up the chain 7 until it is taught. The winch 6 on the middle driven pontoon P2 is then powered in conjunction with the driving shoe 2 on the main pontoon P1 to drive the middle pontoon to the right creating the gap shown in Fig 10C where upon the required winches run back and pay out sufficient chain 7 for a loop or bight to form between the middle and left hand driven pontoons P2. By reversing and altering the sequence of operations of the winches 6 and the driving shoes 2 each pontoon P2 may be moved as required.

In drawing 11/12 the end, or intermediate, vertical sections of a marina with driven pontoons are shown. In plan view (not shown) the layout is similar to that in Fig 10A save that in Figs 11A - 11D the vertical end view or sections of four, not three, driven pontoons P2 (P2, W X Y and Z) are shown with piled P4 pontoons PO to left and right. Referring to Figs 11A - 11D a 'lacing' arrangement of anchoring and drive chain 7 is schematically shown in relation to a ground chain 8 and to driven pontoons P2 and to opposing states of the tide.

The common features of Figs 11A - 11D are winches 6 mounted on pontoons PO or piles P4 as shown. On left hand pile P4 one winch 6 controls a ground chain 8 which runs down the pile P4 and is turned by means of a pulley or fair-lead 9 to run

across the sea bed to another fair-lead 9 on the right hand pile P4 where the chain 8 is lead up to another winch 6. Affixed at points along the ground chain 8 are buoyed fair-leads or pulleys 91 through which the anchoring and driving chain 7 may pass freely.

The driving chain 7 is controlled by a separate winch 6 shown mounted on pile P4 on left of figures from where it runs down to a submerged pulley or fair-lead affixed to the pile P4. The chain 7 passes through the buoyed fair-lead 91 and then surfacewards to pass around a chain winch 6 mounted on the driven pontoon P2, from where it returns to pass through the second buoyed fair-lead 91 affixed to the ground chain 8 and so on across the width of the marina until all pontoons P2 are 'laced' to the ground chain 8 where upon the driving chain 7 passing through a fair-lead 9 is led to a second winch 6 on pile P4 shown on right side of figures.

Referring to Figs 11A and 11B the space for craft to manoeuvre into and out of their berths is shown to the right side of driven pontoon P2Z in Fig 11A and between pontoons P2X and P2Y in Fig 11B. From the position in Fig 11A the winch 6 on pontoon P2Z transfers chain 7 from its right to its left hand side thus moving itself (in conjunction with similar duplicated chain arrangements or driven shoe and main pontoon not shown) to the right and to the position shown in Fig 11B. The winch 6 on driven pontoon P2Y does likewise and the gap is transferred to the left as shown in Fig 11B. With a tidal stream in the direction shown between the two figures, pontoons P2Y and P2Z are adequately anchored by means of chain 7 passing through the

buoyed fairleads 91 affixed to the ground chain 8 immediately upstream of them.

Referring to Figs 11C and 11D a similar process of operating winches 6 to vary the position of the gap between driven pontoons P2W-Z as described above may be seen save that in Figs 11C and 11D the tidal stream is shown flowing in the opposite direction. To ensure that a section of driving and anchoring chains 7 laced to the driven pontoons P2W-Z lies upstream for effective anchoring, the ground chain 8 with buoyed fairleads attached 91 is itself moved, by winches 6 on piles P4, to the right. Comparing Figs 11B and 11C a buoyed fair-lead 91 marked S is shown at a distance from right hand pile P4 in Fig 11B and adjacent to the pile P4 in Fig 11C.

To cater for rising and falling water levels, e.g. tides, chain 7 may be passed from or taken up by winches 6 on piles P4 and equalized among the driven pontoons P2 by means of proportionally driving the winches 6 mounted on them.

Referring to Fig 12A, in drawing 12/12, an end view or mid point vertical sections of two driven pontoons P2 are shown. The anchoring and driving chain 7 is shown passing through buoyed fairleads 91 affixed to ground chain 8. Before passing around the winches 6 mounted on the driven pontoons P2, the driving chain 7 is led through a fair-lead 9 which may be mounted on a submerged framework extending beneath the driven pontoons P2. The arrangement ensures adequate clearance for the draft of vessels passing over the chain 7.

Referring to drawing 12/12 Figs 12B, 12C and 12D show the end or cross section and perspective of a driven pontoon P2 together with a means envisaged to anchor or arrest movement of the pontoon P2 when that is required. The means employed is that of a relocatable pile P42 having at the foot of its vertical members (two shown) points which may be embedded in the sea bed. The vertical members of the relocatable pile P42 which may be linked by horizontal members, pass through guide tubes or frames built in or onto the structure of the driven pontoon P2 and are attached to a motive source 3 mounted on the pontoon P2. The motive source 3 may be an hydraulic ram or electrical/mechanical arrangement (not shown) but is capable of moving the pile upwards and/or downwards.

In operation referring to Fig 12B the relocatable pile is powered by source 3 in a downwards direction until the points are embedded in the sea bed. By tending to lift the pontoon P2 higher out of the water than before, the weight of the pontoon P2 is used to drive the pile P42 into the sea bed. When it is required, Fig 12C, to raise the pile, for example to move to a new position, the motive source 3 reverses and the pile P42 is raised using the buoyancy of the pontoon P2 to provide a lifting force.

The construction of the relocatable pile may be tubular with buoyancy and/or ballast sections contained within it so that the desired degree of effective weight is carried by the pontoon P2 when the relocatable pile P42 is in the raised position.

REFERENCE NUMERALS AND LETTERS USED IN DRAWINGS 1-12

PO	Pontoon, Access Ramp	P.W.	Pontoon Walkway
P1	Main or Base or Driving Pontoon	P1A	Short Section Main Pontoon
		P1AA	Short Section Main Pontoon with Slot for Piles
P2	Secondary or Driven Pontoon	P21	Hinge between Driven Pontoon and Shoe
		P22	'I' Beam Structure of Driven Pontoon
P3	Pontoon Floats		
P4	Pile or Anchoring Point for Pontoons	P41	Mobile Pile
		P42	Relocatable Pile
P5	Finger Pontoons	P50	External Mooring Points
		P51	Mooring Cleats
		P52	Stern Head Mooring Post
		P53	Bow Fender
		P54	Semi Articulate Demountable Fixing and Hinge
P6	Hinged 'Gate' Section of pontoon		
P7	Telescopic or Extending Section of Pontoon	P71	Releasable Locking Mechanism
		P72	'A' Frame Structure
		P73	'U' shaped Link & Guide Rail
		P74	Guide
1	Longitudinal Member		
2	Shoe or Sledge, sliding or wheeled carriage	22	Surface to accept fixing to P2
		23	Wheeled carriage
3	Motor or Motive Source	33	Propellor or Water Jet
4	Worm Gear or Pinion		
5	Rack Gear		
6	Chain or Cable Winch		
7	Anchoring & Drive Chain		
8	Ground Chain		
9	Fair-lead or Pulley for Chain	91	Buoyed Fair-lead or Pulley on Ground Chain
10	Releasable Clamping Mechanism a and b		
	Boats ⊃ floating vessels		

CLAIMS

1. A marina comprising a plurality of pontoons, to which floating vessels are securely moored, which are contained within and are or are moveably connected to a longitudinal or elongate member of an adjacent structure in such a way that the pontoons with moored vessels may be driven together or apart, by a variety of power sources, from one or both ends and or at intermediate points along their length, a means for arresting the movement of the driven pontoons together with means for allowing access by vessels to berths between adjacent driven pontoons.

2. A marina as claimed in Claim 1 wherein the driven pontoons are moveably connected to a rigid elongate member of an adjacent fixed or floating structure which member controls the sliding movement of the driven pontoons.

3. A marina as claimed in Claim 1 or Claim 2 wherein the driven pontoons are moveably connected at both ends to the rigid elongate members of two adjacent and parallel structures together with means of providing intermittently or at all times for the draught of vessels navigating within the marina.

4. A marina as claimed in Claims 1, 2 and 3 wherein the elongate member incorporates an integral rack gear and the moveable member connecting the driven pontoon to the elongate member incorporates a worm or pinion gear driven by a motive source.

5. A marina as claimed in Claims 1, 2 and 3 wherein at least one of the elongate rigid members is fixed and submerged and to which the driven pontoons are moveably connected via perpendicular legs or piles together with means of releasably arresting the sliding movement.

6. A marina as claimed in Claim 1 wherein the elongate members connecting the driven pontoons to adjacent structures are flexible.

7. A marina as claimed in Claim 6 wherein the co-ordinated operation of winches acting on the flexible elongate members drives the pontoons.

8. A marina as claimed in any preceeding claim having a means of securely mooring vessels by the bows bow-to the driven pontoons.

9. A marina with driven pontoons as claimed in any preceeding claim having as a means of arresting the movement of the pontoons a relocatable pile.

10. A marina as claimed in any preceeding claim having a semi-articulate demountable fixing and hinge between the finger piers and the driven pontoon.

11. A marina with driven pontoons substantially as described herein with reference to Figures 1 - 12 of the accompanying drawings.

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